

REMARKS

This is responsive to the Office Action dated February 3, 2003 which has been carefully considered.

Claims 1-4 and 7-30 stand rejected under 35 U.S.C. §102(b) and being anticipated by Rossitto .

Claims 1-3, 6, 7, 9, 11-22 and 29 stand rejected under 35 U.S.C. §102(a) as being anticipated by Tada; and

Claim 5 stands rejected under 35 U.S.C. §103(a) as being obvious over Tada in view of Woods.

Finally, claims 2-7, 9, 10, 13-19, 21 and 24-29 stand rejected under 35 U.S.C. §112, second paragraph, for the reasons stated at page 2 of the Office Action. Withdrawal of the rejections based on the preceding amendments and following arguments is respectfully submitted.

Claim 1 as amended recites the weight ratios of the isocyanate component (original claim 8) and of the isocyanate-reactive polymer component (original claim 12). In addition, claim 1 now requires the presence of a third component, namely, a non-isocyanate-reactive polymer, wax and/or resin (original claim 14). Finally, the content of three NCO-groups in the reactive hot-melt adhesive element has been recited.

New claims 31 and 32 have been added. Also added were claims 33-35 which are the same as process claims 28-30 but now dependent on newly added independent claim 31. Thus, claims 1-7, 9-11, 13-23, and 28-35 are presently before the Examiner, claims 8, 12 and 24-27 having been cancelled.

It is believed that the preceding amendments have overcome the rejections under 35 U.S.C. §112, second paragraph as the limitations that fall within the recited broad range or limitations in the same claims have been deleted. This rejection should thus be withdrawn and the same is respectfully urged.

Prior to turning to the rejections under 35 U.S.C. §§ 102 and 103, a brief review of applicant's invention is deemed helpful. The present invention relates to a self-supporting reactive hot-melt adhesive element comprising a one-component hot-melt adhesive, a process for its manufacture, its application and its use. In addition, the present invention relates to an adhesive bonding process for the permanent bonding of substrates.

The present invention has overcome one of the major disadvantages of the prior art namely, the need for a support element. In other words, the present invention provides a reactive hot-melt adhesive element that does not require a support element. In addition to not requiring a support element, the present invention can be easily stored and further processed while retaining its excellent adhesive properties. More specifically, the self-supporting reactive hot-melt adhesive element of the present invention can be used without any complicated melt-on and/or application devices required by the prior art. Finally, the claimed reactive hot-melt adhesive element exhibits high moisture and heat stability. (See specification at p. 3, l. 18 to p. 4, l.4.)

These objects and advantages are achieved by the claimed hot-melt adhesive element which comprises, in addition to the recited amounts of isocyanate and isocyanate-reactive polymers, an additional amount of up to 60% w/w relative to the reactive hot-melt adhesive element of a non-isocyanate reactive polymer, wax and/or resin. The addition of the recited non-isocyanate-reactive component significantly improves the processability of the reactive mixture since the two reactive components (isocyanates and isocyanate-reactive polymers/resins) are not in direct contact with

each other so that the hot-melt adhesive element can be easily formed into foils, films, strips, tapes and the like. Further, the presence of the non-isocyanate-reactive component prevents the undesired and premature reaction between the reactive components. In other words, the composition is stable and will react only when the inventive hot-melt adhesive element is exposed to either moisture and/or heat.

The presence of the non-isocyanate-reactive polymer, wax or resin also guarantees the presence of a high amount of free NCO-groups and results in a reduced tackiness of the surface of the inventive hot-melt adhesive element at room temperature so that the claimed hot-melt adhesive element can be easily processed, for example, into rolls. Only when the claimed hot-melt adhesive element is exposed to moisture and/or heat, the adhesive element become sticky or tacky so that the tackiness of the surface of the claimed hot-melt adhesive element is easily controlled due to the presence of the recited non-isocyanate-reactive component.

Newly added independent claim 31 is directed to a hot-melt adhesive element comprising a mixture of at least two aliphatic and/or aromatic di- and/or polyisocyanates being solid or liquid at room-temperature wherein at least one of these di and/or polyisocyanates is an unsymmetrically substituted di- and/or polyisocyanate having isocyanate functions of different reactivity. This specific embodiment of the present invention has the advantage at the isocyanate groups of low reactivity do not react with the isocyanate-reactive component and therefore remain unreacted, thus ensuring a content of free NCO-groups which will react only upon application of heat and/or moisture during the use of the hot-melt adhesive element. Furthermore, the presence of unsymmetrically substituted isocyanates leads to a higher selectivity of reaction and thus also to an increased storage stability and higher processing temperatures. (See specification at p. 5, l. 15 to p. 7, l. 5.)

To summarize, the claimed self-supporting reactive hot-melt adhesive element has the following advantages:

- (a) It requires no support which greatly simplifies its application in the adhesion process;
- (b) It is non-sticky or non-adherent at room-temperature;
- (c) It has excellent storage stability of at least one month; and
- (d) It can be formed into a reactive adhesive tape which can be wound into a roll which simplifies its application as well as its storage.

Turning now to the rejection of claims 1-4, 7, 9-11, 13-23 and 28-30 under 35 U.S.C. §102(b) as being anticipated by Rossitto, it is noted that Rossitto discloses a hot-melt adhesive with low application temperature (65°C - 82°C, col. 2, ll. 53-54) comprising a partially reacted blend of an aliphatic polyester and a trifunctional isocyanate (Abstract). This differs from the claimed invention. First, it is noted that Rossitto fails to disclose or suggest the use of a non-isocyanate-reactive polymer, wax or resin in amounts of up to 60% w/w, which leads to the advantages discussed above. Furthermore, Rossitto also fails to disclose or suggest the use of unsymmetrically substituted isocyanates (new claim 31). Thus, Rossitto fails to anticipate applicants' invention as now claimed.

Rossitto mixes an isocyanate-reactive polymer (component A) and polyfunctional isocyanate (component B), the latter in substantial stoichiometric excess (col. 2, l. 64 and following), the blend having a branch number of 1.5 or more, blended at an isocyanate index of from about 150 to 1,500 (col. 3, l. 13 and following). The isocyanate reactive components have an average molecular weight greater than 8000 Da to about 30,000 Da (claim 1, col. 1. 43). The reaction mechanism is disclosed at col. 9, l. 26 to col. 10, l. 46 as follows: In the first reaction, a

slow reacting polyisocyanate reacts with reactive groups of the polymer to create an adhesive pre-polymer that is polyfunctional; this reaction occurs, at least in part, during initial blending. The term "partially reacted" indicates that the adhesive package has less than about 30 weight % of the originally available isocyanate groups reacted with the reactive hydrogens. The uncured adhesive package has to be stored below 5°C (col. 9, l. 19).

Again, Rossitto fails to disclose, explicitly or inherently, the subject matter claimed by applicants. Applicants' invention describes hot-melt adhesive elements where the functionality of the pre-polymer is about 2, hence the branch number is about 1. The claimed isocyanate includes aromatic isocyanates. The only exception is IPDI and its oligomeres. This polyisocyanate is solid at room temperature. As set forth in applicants' Example 1, which is directed to solid isocyanates, it is evident that no reaction takes place between the isocyanate-reactive polymer and the solid isocyanate before application of the adhesive element of applicants' invention, thus ensuring a high content of free NCO-groups.

The use of liquid isocyanates is not disclosed by Rossitto at all. Applicants' films are generally stable at room-temperature for at least one month. Rossitto states, at col. 8, ll. 22-25, that mixing of the polyol and polyisocyanate occurs "without significant reaction" (as is also noted by the Examiner at p. 3 of the Office Action). The Examiner, however, appears to have overlooked that this mixing is performed in a dry, sold, granular form (col. 8, ll. 14-17). Thus, a mixture of granules is produced. In order to produce a film, Rossitto teaches to partially react the blended material in a subsequent film forming step, i.e. in a film extruder (col. 8, ll. 25-28). Thus, according to Rossitto, production of a film leads to at least a partial reaction between the isocyanate polymer and the solid, aliphatic polyisocyanate (see also Rossitto claims).

The use of catalysts, as mentioned by the Examiner, to accelerate the reaction of isocyanates is known generally for about 60 years. But, depending on the individual polyurethane systems and applications, the effects of the catalysts may differ. Thus, a catalyst proposed by Rossitto does not necessarily improve the performance of a liquid isocyanate based hot-melt element.

Again, Rossitto fails to disclose or suggest the use of a non-isocyanate-reactive polymer, wax or resin in amount of up to 60% w/w as well as the use of unsymmetrically substituted isocyanates. Accordingly, the rejection of the claims as anticipated by Rossitto should be withdrawn and the same is hereby respectfully requested.

Turning now to the rejection of claims 1-3, 6, 7, 9, 11 and 13-22 as anticipated by Tada et al., it is noted that Tada et al. describe a reactive hot-melt adhesive comprising a blocked prepolymer made by reacting isocyanate groups with a blocking agent (col. 13, ll. 36-40).

Like Rossitto, Tada et al. also fail to disclose or suggest, explicitly or inherently, the non-isocyanate-reactive polymer, wax or resin now claimed by applicants, including the claimed amounts of up to 60% w/w. Tada et al. are also silent with respect to the use of unsymmetrically substituted isocyanates. Accordingly, Tada et al. do not anticipate applicants' invention as now claimed and withdrawal of the rejection is respectfully solicited.

Turning now to rejection of claim 5 as being obvious over Tada in view of Woods, the Examiner notes that secondary reference Woods demonstrates that mixtures of 4,4'-diphenylmethane diisocyanate (4,4'-MDI) and 2,4'-diphenylmethane diisocyanate (2,4'-MDI) are known and 4,4'-MDI usually contains some 2,4'-isomer. This observation does not render applicants' claimed invention obvious. In applicants' claimed invention, i.e. in 2,4'-MDI-rich isocyanate mixtures, no blocking agent is used. Tada et al., as discussed above, uses a blocking agent. Thus, the combination of Tada et al. with Woods does not lead to applicants' claimed

invention. In addition, 2,4'-MDI-rich isocyanate mixtures have only recently become available. For example, a relatively high concentration of liquid 2,4'-MDI is advantageous to yield films according to the present invention (example 2). Thus, it would not have been obvious to a person of ordinary skill in the art at the time the invention was made to formulate a hot-melt element based on non-blocked unsymmetrically substituted isocyanates such as, e.g., 2,4'-MDI-rich isocyanates. Accordingly, the rejection of claim 5 as being obvious over the combination of Tada et al. and Woods should be withdrawn and the same is hereby respectfully urged. In addition, claim 5 depends on amended independent claim 1 and should be allowable for that reason alone.

Any additional fees or charges are required at this time in connection with the present application; may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,

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